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NASA TECH BRIEF

Prediction of Gas Leakage of Environmental Control Systems

Theoretical determination of gas leakage rates of environmental control systems (ECS) depends largely upon assumed geometry conditions. Mathematical models of leakage configurations and various flow theories (including orifice, capillary and laminar pipe) are presented with the substantive experimental test data in order to provide background material for future design and failure analysis.

Two types of leakage are considered: low, normal-rate leakage and emergency high-rate leakage. It is assumed that the ECS pressure remains constant for the low rate; and on the other hand, the high-rate occurs when pressure decay occurs in the ECS. Basic assumptions for the flow theories are: when the hole diameter is large compared to length, orifice flow occurs; leakage path in capillary flow is assumed to be a long, straight tube; continuum flow at constant temperature is assumed for the laminar condition.

The experimental instrumentation for determining steady-state leakage tests agrees quite well with the theoretical models from ECS pressures of 5 to 10 psia. Pressure decay tests were also run in a 157 cu. ft. ECS. The air lock was charged by metering-in the test gas to the partial pressures corresponding to the test atmospheres. Data were obtained using helium and nitrogen as diluents with the oxygen partial pressure held at 3.5 psia. One pertinent finding in the helium-oxygen atmosphere was the premature failure of certain types of electronic instrumentation, notably seven vidicon television monitoring tubes.

Note:

The following documentation may be obtained from:
Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Single document price $3.00
(or microfiche $0.65)

Reference: NASA-CR-891 (N67-37320),
Engineering Criteria for Spacecraft
Cabin Atmosphere Selection

Patent status:

No patent action is contemplated by NASA.

Source: Jack K. Jackson and Emory C. Thomas of
Douglas Aircraft Co.
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